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ABSTRACT

This paper reviews five popular and emerging models for the implementation of Internet and network technology in higher education: low tech, lab, laptop, virtual, and networked systems. Three perspectives on these models--that of a faculty member at the University of Lethbridge (Alberta, Canada), an administrator at the University of Lethbridge, and a student at the University of Alberta (Canada)--are then examined. Comments are included on the incorporation and day-to-day use of these technologies, concerns and hopes for the technologies, and the future of the technologies' roles within the greater academic and institutional environments. A chart presents the benefits and deficits of each of the models. (Contains 15 references.) (MES)

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Perspectives on the Implementation of Instructional Technologies into University Environments: Faculty, Administrator, Student

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Abstract: Institutions of higher education have been struggling with various models of implementation of Internet and network technologies. This paper reviews five popular and emerging implementational models and examines three perspectives on these models – specifically, that of a faculty member, an administrator and a student.

The use of Internet and computer technologies in university teaching and learning has provoked institutions of higher education to re-think some basic organizational issues. The scope of the technological undertaking, especially in the context of world wide networking that is facilitated by the Internet, is daunting. Many of the mechanisms underpinning and enabling work in this area must be centrally implemented and supported. And while traditionally, academic units (faculties and departments) at universities have enjoyed and indeed thrived with varying degrees of autonomy, the cost, including the physical, human resource, and transactional of implementing teaching augmented or supported by network-based technologies can be staggering. Thus, new models for university structures are emerging, which are changing traditional political and academic activities, imperatives, motivations and procedures. This paper addresses implementation issues by first setting a context of some accepted models for technology deployment in institutional contexts, and then addressing these models from three vantage points. The emerging models of higher learning and the implications of these transformations transcend societal boundaries – involving the taxpayer, the student or prospective student, the parent, the university employee, faculty member and administrator. Within the boundaries of a classical university, this paper relates the views of a cross-section of direct participants, including a student, a faculty member and an administrator. All are involved in technology at the institutional level and both the faculty member and administrator are involved in systemic, provincial implementations and co-ordination of technological decision making.

Network technologies and the Internet, wedded with the traditional academy, have produced hybrid institutions of learning. In the following pages five models of institutional technological deployment will be described to set a context for the subsequent discussions. There are real world examples of each model, and the list is by no means exhaustive. Many hybrid models exist. As the academy evolves into the new technological environment, there is no doubt that new models will emerge and that increasingly, institutions will feel compelled to adopt an optimal choice for their technological activities to meet their mandated responsibilities.

- **Low Tech:** A number of institutions, especially smaller ones, are finding it difficult to compete with the technological innovations of larger institutions. Since technological infrastructure is expensive, as are initial investments in network infrastructure - switching and server costs are not necessarily directly correlated to student enrollment - the cost of installing and maintaining instructional technology is often not within the means of smaller institutions. There are a number of other compelling reasons that institutions may not choose to invest in instructional technology, including:

$ an institutional plan to occupy a niche market may mandate an investment in faculty instead of technology. A guarantee of small classes and personal attention may serve to situate a small institution very favourably in the post secondary market

$ an institution may decide to upgrade traditional learning support systems - libraries, etc. - rather than transform them through technology

$ an institution may decide to identify and support it's existing technological strengths, rather than work towards a ubiquitous deployment of technology. This type of clustered technology plan mandates investing in existing specialized high output research projects (ie. electron microscopy, particle acceleration, magnetic resonance imaging, radio astronomy, physics simulation, biometrics, etc) rather than student labs, faculty and staff computing facilities, etc.

$ risk avoidance

$ uncertainties about the future of any given technology

$ funding sources may not permit the deployment of expensive pilot programs

This low-tech campus option, the option to not deploy technology, is often overlooked in technology planning.

- **Lab:** The Lab campus reflects a standard model for the distribution of technological resources in an institution. Computers are kept in labs which are monitored by proctors, and are available for general use when not booked for specific classes. The upgrade and maintenance of lab machines has traditionally been an issue affecting the effective deployment of this model. Centralized machines are easy to access, and track. Software and hardware upgrades to desktop computers are however, labour intensive and repetitive, as each machine must be individually maintained. Lab machines are usually replaced every three years. Students in most institutions are more and more reliant on computers for course work, composition, and research and so the demand for the machines rises, as does the demand for software, maintenance and support. Thus institutions working with this

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model are constantly expanding and upgrading general-purpose computer facilities. The cost of maintaining the facilities rests solely with the institutions. Pedagogically, and socially, the lab is an odd place. The designation and most lab deployments reflect its historical use as a scientific research area. Modern computer labs host a great variety of activities (lectures, synchronous and asynchronous conversations, interactions with curricular software, etc). Additionally, the popularity of e-mail has turned the computer into a means of social communication, so that often, a lab hosts curricular and social interactions simultaneously.

- **Laptop:** The concept of the laptop university is quickly gaining popularity. In this model, the institution provides a network infrastructure that connects all the spaces used by both faculty and students. The student bears the cost of buying the machine - a portable version of the desktop. The multifaceted activity taking place in the lab is thus no longer constricted in terms of space, and can take place in more appropriate or intuitively attractive settings. Researchers can work in the Library with access to the appropriate reference materials, some assignments can be done at home and writing love letters can be a private process, carried out in an appropriately secluded part of campus, or on a grassy hilltop surrounded by the bounty of nature. Laptop universities however, require a fairly elaborate infrastructure to support a successful deployment.

$ Students are faced with a steep learning curve when they first encounter the system, and the mechanics of taking the technology-augmented courses need to be addressed in the introductory curriculum - necessitating an additional curricular development project. This is an even greater issue when instructors choose different courseware packages to deliver their on-line courses.

$ Deployments of laptop universities generally rely on a corresponding, centrally mandated conversion of curriculum into electronic format.

$ A fairly elaborate customer service model for the maintenance of the machines must be implemented to technically support students and professionally develop faculty.

- **Virtual:** Virtual institutions are becoming more and more prevalent. The designation can denote a number of real institutional configurations. Most virtual institutions are Internet-based schools delivering web-based courses, with varying degrees of opportunity for face to face traditional classroom-based instruction. Some exist only on the Internet, relying principally on lifelong learners as a student base and work at expanding the traditional distance education markets. Some, like Western Governor's University, use seconded faculty and have no permanent faculty members. Virtual institutions are geared towards providing an educational service to clients who, for geographical, lifestyle, work, or other reasons, do not want to or can not attend a traditional campus. This is the traditional distance learning market, but the virtual institution is offering a more refined, quicker, more satisfying, more academically and socially engaging experience than print-based distance courses have achieved. Virtual campuses generally strive to gauge the needs of traditional students and deliver comparable services to remote students.
- **Networked System:** A new model for politically mandated integrated post-secondary systems is being examined in a number of geographical areas, among them the province of Alberta, in Canada. This model demands that curricular material and credit be fluid and systemic. It depends on the notion that students need not be tied to an institution and that they would be better served by a system consisting of discrete, identifiable parts. It also depends on an integrated and co-ordinated deployment of technological tools to facilitate an individualized learning system. This model requires a great deal of political decision making, and negotiation, but affords students the opportunity to build degrees, diplomas and certificates from a wide range of possible providers. Students, as consumers of the system, are empowered to choose the mode and content of the courses they take.

While each of these models can be compelling, simple and perhaps even obvious, and each provides a solution to an identified problem, each also is rife with implications that are pervasive and stand to transform academic institutions as we know them. Because the impetus driving the incorporation of network technologies into the teaching and functioning of universities around the world is political and economic as well as academic, these models of institutional uses of technologies or institutional refashioning are compromises that seem to please few involved in the transformative processes. The function of planning has changed in the technological environment along with the relative importance of various institutional plans. More importantly, the need to integrate various plans, always a goal of institutions, has become a necessity without which, universities can flounder and fail. Additionally, the emergence of technologies as mediating agents in curricular, social, economic and support transactions has encouraged a degree of interdisciplinarity and integration, an imperative for institutions, departments and individuals to trespass over boundaries that are seminal to the traditional academic institution's operation.

Perspectives

The perspectives of three individuals from stakeholder groups strongly affected by technological refashionings in educational institutions are represented in this section of the paper: a faculty member, an administrator, and a student. All three have been involved with network-based technologies and have seen their environments adapt in response to them. Each will comment on the technology models described and each will provide their unique perspective on the process of incorporation as well as the day to day use of these technologies in the context of an academic institution. As well, each will address concerns and hopes for the technologies and speculate on the future of their roles within the greater academic and institutional environments.

Faculty Member

As a faculty member at the University of Lethbridge, I lead technology planning and implementation and help other faculty to integrate appropriate technologies into their curricula. I also research and assess new instructional technologies. Additionally, I

sit on the Alberta provincial Advisory Committee on Educational Technology, and participate in the affiliated Standards Task Group.

My background and current position lead me to believe that centralized, cross-disciplinary and long-term planning for technology implementation is vital to the success of any institution considering a technological renaissance. Each of the models included in the panel summary has its merits. Some are economically efficient, some are elegant and simple, and some are flexible. My enthusiasm for them is tempered by my concern about traditional academic values and the traditional academic environment that has proven so conducive to the creative pursuit of new knowledge.

As a faculty member and a stakeholder in the higher education system, as well as a taxpayer and parent, I am concerned that academic autonomy, so fundamental to the academic culture, is being compromised in the process of implementing technology. The new forces molding the academy include business concerns and political pressure – both forces traditionally involved with administrating and funding higher education, but not with the development of curricula. In some of the models listed in the introductory paper, it is apparent that curricular change is being mandated systemically. This flies in the face of academic freedom, which is fundamental to the institution of the university. Although I recognize the need to rework the methods of implementing technologies to take advantage of economies of scale optimizing both physical and intellectual resources, I feel that caution ought to be exerted and much thought devoted to the larger implications of these changes on scholarship, creativity, critical inquiry, and intellectual development.

The Low Tech option, for instance, is naturally appealing, especially to faculty members at small institutions. This model seems to leave intact the fundamental structure of the university, preserving it in time so to speak. However, what of faculty who wish to pursue technologically augmented teaching? What of students who need to be comfortable with technology in order to be job ready? Again, institutional motivation comes into play. Are we serving the taxpayers who foot the bill? Are we serving students, who also pay? Are we serving the greater good by developing new knowledge? Are we accountable to the politicians who dole out the funds? Are we responsible to corporate bodies who donate research funds? University policy, in fact, treads a fine line of compromise winding between these and other forces.

Fundamentally, these teleological issues need to be resolved before the issue of technology even begins to be addressed. Once an institution has established its purpose, and fundamental motivation, the rest of the issues are academic. For instance, if the focus is on students, as clients of the university, their experiences and education, then obviously small classes are important – students learn better with more. As well, technology is important, since students need to have access to it in order to do their work and qualify for jobs. As custodians of their money and futures, we should create an environment optimal for students.

However, the situation is never simple. Institutions of higher learning function in a multifaceted context. As faculty members we are rewarded generally, for our work in research first, teaching next, and service to the university and community last. This necessitates working in an environment that streamlines the production of curricular materials. The economies of scale can work for us here, ensuring that the technological context for our work is centrally implemented and supported, that our research and curricular assistants are working in a single technological context, minimizing the need for technical re-training.

Another issue that must be reflected upon before embarking on any scheme to refashion the academy is the relationship between the content and delivery of curricular materials. Two of the models initially discussed, the Laptop and Virtual, mention the redesign of curriculum. In the spirit of acknowledging the relationship of the medium and the message, institutions must accept that redesigning curriculum for delivery in a technologically augmented or mediated environment means tampering with course content. Instructors must be free to choose the best mode of delivery for a content area, rather than try to fit a subject into a context that may not be conducive to the delivery of that particular subject. Even more disturbing is the assumption that existing course materials can be handed over to an outsourcing agency, which can "transform" them into a format suitable for electronic delivery.

Granted, the realities of the modern academic environment dictate that long term technological planning be visionary and binding. However, it also has to be integrative and thorough. It needs to take into account the mission, goals and underlying purpose of the institution. It has to acknowledge the complete cost of the work – including the increased workload on faculty, who ultimately, are the front line workers in the enterprise. Any externally mandated curricular transformation must be accompanied with tangible faculty rewards and a complete technical and intellectual support system. Furthermore, it must include professional development for faculty who need to work with new and different paradigms for instructional design.

Ultimately, it is hard to conceive of an academic future where technology plans are not centrally developed. Economic realities are compelling institutions to adopt centralized and comprehensive planning policies that include curricular changes. It is vitally important, however, to acknowledge in these planning processes the academic structure and atmosphere that has facilitated the scholarship, critical and creative, to date. I predict that future institutions will attract faculty not just through strongly developed research opportunities, but also through well developed and implemented planning, especially technological planning which will set a context and environment for their teaching and professional growth.

Administrator

I work in a senior administrative position at the University of Lethbridge and focus on the areas of project management and institutional planning. My responsibilities include maintaining awareness of both internal directions and external issues, trends, and policy directions for the provincial post-secondary system. I serve on various institutional and provincial technology integration planning committees, and provide liaison between government policy makers and university administrators and faculty members.

While the range of learning and educational technology options increases, so too does the potential for misunderstandings and accusations of unrealistic expectations among the various stakeholders. From the perspective of a seasoned post-secondary institution and government administrator, I will present some of the economic, political, and administrative considerations that must inevitably, and hopefully consciously, factor into the selection any of the identified technological options.

To set a context for my position, I will first identify some of the relevant characteristics of the Alberta post-secondary system and, more specifically those of the University of Lethbridge. I will not, however, identify a preferred option. I do not have a recommendation for the provincial system, nor for that matter for the U of L. To do so would also presume some planning decisions that are outside my area of expertise and purview. Inarguably, all post-secondary institutions are in the business of providing educational and/or skills training opportunities that best address student needs, meet their mandated responsibilities and the demands of the economy. I see the administrator's role as helping to facilitate, plan for, and implement the option identified as being the most pedagogically and conceptually sound by the educators who have conducted the research necessary to determine which are the most appropriate learning environments.

Twenty-six Alberta institutions, ranging from vocational/upgrading colleges to four universities, compete for dwindling tax dollars that are earmarked for publicly funded post-secondary education. The U of L is a relatively small institution (approximately 5400 students) that is mandated to deliver liberal education and professional preparation through its five faculties and schools (Arts and Science, Health Sciences, Education, Management, and Fine Arts).

In 1994 the provincial government set out a new direction for its publicly funded post-secondary institutions. It identified numerous initiatives that focused on increasing responsiveness, accessibility, accountability, and affordability (both for taxpayers and students). What was very apparent, and new to the system, was the increased emphasis on:

- reducing system-wide duplication of programs and services;
- rewarding institutions for developing collaborative undertakings;
- increasing the number of student seats in high demand program areas;
- increasing rewards for learner-centred practices including, for example, seamless student services (electronic application service);
- providing only for rationalized infrastructure expenditures;
- standardizing reporting processes; and,
- promoting innovative practices e.g. integration of technology and recognizing more business oriented credentials ie. those with either a significant co-op or practicum component such as post-diploma and applied degrees.

Another of the major changes was the move from formula-based (percentage based strictly on student enrolment numbers) to envelope funding which required that institutions adopt a more entrepreneurial orientation and compete for various funding envelopes. At the same time, institutions were struck with a 21% (over 3 years) cut to their operational budgets. More market responsive and business driven decision-making was obviously required. Cost effectiveness became the focus of post-secondary administration. Regular business, technology integration, research, and accessibility plans were required from institutions in order to regain maximum funding. Within an increasingly competitive environment, the requirement for enhanced inter-institutional collaboration became, and remains, an anomaly. Student tuition fees were also capped at 30% of operating costs.

Faculty and student expectations, without the benefit (or disadvantage, depending on perspective) of being in direct contact with policy makers and funding agents, were slower to respond to the changing requirements and assumed that business would continue as usual. Personal objectives and goals, due to economic necessity, became subordinate to achieving institutionally mandated responsibilities including what were presumed to be technological efficiencies in educational delivery. Faculty members, in the absence of having had the opportunity to develop their knowledge and expertise or even conduct research into the pedagogical implications, felt pressured to adopt technological alternatives either on a broad or limited scale. A kind of 'shoot the messenger' mentality seemed to emerge as administrators were seen as being responsible, if not wholly, in part at least, for not being able to re-deploy resources in a way that would not impact the teaching/learning environment.

Due to external politically- and economically-imposed pressures, institutions sought the means by which to enhance accountability results in order to secure higher funding allocations. In this context, alternative means of educational delivery via technological assistance were examined. Universities started to pay greater attention to market demand - students, their advisors, and parents were increasingly seen to be *customers* of institutional services. Streamlining and simplifying administrative procedures, as well as student and support service delivery, generally expedited through some technological assistance for such important processes as financial, counselling, and registration, required that internal processes be more widely understood and communicated. Responsiveness to market demand and competitive pressures, despite the crassness of its ring to educators, became necessary. It would probably not be an overstatement, for some institutions at least, to say that institutional preservation continues to depend on making good, fiscally sound choices - with little room for error. Administrators, by virtue of their 'watchdog' status, have the appearance of presuming to interfere with academic delivery. Preferably, theirs could be viewed as more of a mediational role - communicating and interpreting external constraints while appreciating and respecting internal educational preferences and directions.

A few of the specific considerations that administrators are obliged to address that directly relate to the various technological options include:

- physical space change requirements - more, less, or different use
- collaborative arrangement coordination
- one-time and setup vs. lifetime costing
- approval processes
- policy implications

- project management
- process planning
- timeline coordination
- publication and communications requirements
- effect on total program array and/or change in student numbers
- professional development and/or training considerations
- maintenance, upgrading, and replacement costs
- intellectual and/or product ownership implications
- impact on student tuition and/or other transferred costs
- staff and faculty number and location implications
- funders eligibility criteria, guidelines for disbursement, and subsequent reporting requirements
- revenue generation opportunities
- coordination of response time with market demand forecast
- consistency with strategic direction
- risk management

These represent only a few of the considerations that are possibly less evident to faculty members as they select from the presented, or other, technological options. Some are undoubtedly unique to the Alberta post-secondary system; others are likely common regardless of jurisdiction or type of institution. They are presented to provoke discussion and indicate the range of administrative considerations that are inevitably important to complement educational delivery change decisions. Consultative planning, which implies developing an appreciation of all stakeholder perspectives, is necessary prior to decision-making to minimize unpleasant surprises and maximize positive outcomes.

Student

In September 1995 I became a University-transfer student of Concordia University College and transferred in 1997 to complete my BA (Honours, Psychology) in May 1999 from the University of Alberta in Edmonton. I have not taken any distance courses, but I have been exposed to an array of classroom technologies. I have made extensive use of computers, both in the student labs at University and at home. When I graduate, I expect that computers will be part of whatever career path I decide to pursue and that I will constantly have to learn new applications and deal with different interactions involving computers.

My use of computer technology while attending College and University was mostly directed at my studies. I used word processors, databases, spreadsheets, statistics programs, and presentation software regularly. I also used a variety of tools to access the Internet for research, library and other. As well, e-mail was, and continues to be, a fairly important part of my life – both for academic and career research work as well as for social purposes.

I can see that there is real and undeniable value to technology - especially the kind that lessens the on-campus residency requirements - perhaps more for other students than for myself. For instance, disabled students, who are unable go to campus for regular face to face instruction, mature students returning to school, at-home parents, or those with full time jobs have access to a world of education that circumstances had kept them from before. As well, computer communication allows people to easily keep in touch with people anywhere in the world. This is important not only to students looking for mentors or information in remote places, but also to people whose interests are not shared with those in their local communities. The typical student however, like me, values the campus experience mostly for its social opportunities. The university is a setting where we meet peers, socialize with like-minded people, argue and persuade, learn from each other and enjoy each other's company. This is not something I would be willing to give up, even for very effective communications technology. Although e-mail is a social tool for me, I would not want it to be the only one.

The five models described in the introductory paper are all ones that I have heard mentioned by students and professors alike in discussions of possible futures for the University and possible ways of conducting courses. My comments are based on my presumptions about the benefits and deficits of each option. I have attempted to briefly point out the most significant positive and negative aspects from a student's point of view.

University Model	Benefits	Deficits
Low Tech	♦ tuition <u>should</u> be cheaper	♦ restricts students' future opportunities ♦ employers may pass over this type of experience in a high tech society
Lab	♦ cheaper than having to buy your own computer	♦ chaotic environment, in many labs there is no privacy for e-mail or quiet work ♦ students who own computers subsidize those that don't and rely on the labs

Laptop	♦ students can work, study, and do their research in a variety of settings, for instance, at home or work	♦ expensive – tuition is already too high, and students are graduating with too much debt
Virtual University	♦ limits some costs and provides convenience	♦ limits some day to day social interaction
Networked System	♦ convenient for students who want to mix on-line with regular courses and who don't want to leave their homes to attend school	♦ maintaining the value of the credential ♦ limits options for individual course selection i.e. reducing duplication also reduces choices

As you can see, no single model emerged from this exercise as a clear winner. I think that I can unequivocally say that I would not want to get my degree from either a Low-tech or Virtual University. I need and want technology in my education, but I do not want it to be the focus of what I do. I am first and foremost interested in psychology, in its course content and the related research. I want psychology to be the focus of my career and for technology to enable me to be the best I can be in that field. I worry that the emphasis on technology in delivering university education will divert it from what's important to students, from what keeps students like me at university. Technology will not be the focus of my life, but I do appreciate and enjoy its utility in helping me learn, research, share information, keep in touch with friends, be entertained, write, and I look forward to whatever else it will do in the future.

Technology has the potential to make student life much less complicated. It could eliminate lineups for student services, and streamline the bureaucratic entanglements that students have to clamber through. It could help students who are transferring from one school to another to know exactly what to expect in terms of credits, services and requirements at the new institution. It could give students more choices about their own education. I hope that this is what technology ends up doing in universities. The possibility exists that it could also just add another layer of cost and intricacy to the whole experience, which is already expensive and complicated. It could, potentially, free up time to 'learn'.

Future Considerations

Clearly, technology is very much a matter of concern and contemplation for various stakeholders in university education. Each considers the academic and professional impacts, or potential impacts of technology. The selection, deployment, and implementation of technology in university curricula have far reaching consequences, and it seems that these consequences will affect us whether or not we choose to participate in the processes. Pressure from students, governments and industry will eventually ensure the integration of network technologies into portions of all university curricula.

The three individual perspectives provide a sample of the some of the more general concerns that face university faculty members, administrators, and students. Probably the most important point prior to making any far-reaching, resource intensive decisions that will have significant professional and academic impacts is to have a clear understanding of the expected educational outcomes. The stakeholder perspectives need to be confirmed and elaborated or refuted by a representative cross-section. Perhaps equally as important is that this feedback be complemented with perspectives from those not as directly involved in technology integration (parents, business community, other university staff, college personnel, government employees, potential students, etc.) to develop a more comprehensive picture. Presumably then, confidence will be enhanced in the suitability of the chosen option, resources to support the change will be more readily forthcoming, and there will be greater assurance that educational benefit will be realized.